ON THE ALLEGED QUEENSLAND MOA, *DINORNIS QUEENSLANDIAE* DE VIS

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ABSTRACT

Examination of the holotype of *Dinornis queenslandiae* De Vis, a part left femur, has shown that it is from a *Pachyornis elephantopus* (Owen) derived from a Moa-hunter Maori midden from the South Island of New Zealand and it must therefore be expunged from the list of Australian fossil birds.

In 1884 C. W. De Vis, then Director of the Queensland Museum, described the holotype femur as *Dinornis queenslandiae*. In his first paper he stated that it "was recognised in a collection of bones from King's Creek, presented to the Queensland Museum by Mr. J. Daniels, late of Pilton". Subsequently (De Vis, 1891) he stated more specifically that it was "picked up in King's Creek, on the Darling Downs, by Mr. Daniels and by him presented with other contemporaneous fossils to the Queensland Museum". I shall show later that the bone did not belong with the other King's Creek material. It is certain that De Vis did not at any time question its derivation and in his original description he realised its close resemblance to "*Dinornis elephantopus*" and to "*Dinornis crassus*" (= *Euryapteryx gravis* of modern classification). In De Vis' day there was great confusion between what today are known as *Euryapteryx*, *Emeus*, and *Pachyornis* as few, if any, skeletons were available for comparison and classification was done mainly on leg bones). It is all the more to his credit that with very little comparative material, if the Moa collection in the Queensland Museum today is any guide, he realised the affinities of the fragmentary bone which he was examining. Lydekker (1891) and Jack and Etheridge (1892) accepted the bone as a Queensland Moa without question. In 1893 F. W. Hutton, working from a rather poor cast (still in the Canterbury Museum), compared it with *Euryapteryx gravis* and "*Euryapteryx ponderosus*" (= *Pachyornis elephantopus*) and concluded that it was not a Moa and placed it among the Casuariidae, stating "it probably represents the ancestors of the Emus and Cassowaries".

There the matter rested until 1949 when Dr. W. R. B. Oliver, who had had the holotype bone for examination rightly recognised it as belonging to the genus *Pachyornis* but, accepting the Queensland derivation, published it as *Pachyornis queenslandiae*. In 1963 Alden H. Miller, working from the five excellent photographs published by Oliver, but accepting Hutton's arguments, called it *Dromiceius queenslandiae*.

From examination of the cast and from Oliver's photographs, I had already had my suspicions about the bone in question and on 10 April 1967, through the courtesy of Mr. J. T. Woods, Director of the Queensland Museum, and Mr. A. Bartholomai, Research Curator (Geology), was able to examine it at the Queensland Museum and subsequently at Canterbury Museum. Messrs. Woods and Bartholomai were already suspicious of the bone because of its great difference in colour and general appearance from the other King's Creek material—a difference which was strikingly apparent when I also looked at bones from King's Creek. With many years of experience of handling thousands of Moa bones from caves, swamps, sandhills and Moa hunter middens, I recognised the holotype as a bone from a South Island, New Zealand, midden and that it was almost certainly *Pachyornis* as Oliver had stated.

It is significent that both De Vis and Oliver, who had handled the actual bone, as well as myself, recognised its resemblance to *Pachyornis elephantopus*.

Pachyornis elephantopus (Owen, 1856)

Dinornis elephantopus Owen, 1856, p. 54.

Dinornis queenslandiae De Vis, 1884, pp. 23–8, pls. 3 and 4. Lydekker, 1891, p. 222. Etheridge, 1892, p. 662.

Pachyornis elephantopus (Owen): Archey, 1941, pp. 36–9.

Pachyornis (*Pachyornis*) *elephantopus* (Owen): Oliver, 1949, pp. 74–80, figs. 53–61.

Pachyornis queenslandiae (De Vis): Oliver, 1949, pp. 80–3, 88, fig. 61 A–E.

Dromiceius queenslandiae (De Vis): Miller, 1963, p. 417.

The holotype of *Dinornis queenslandiae* is the partial proximal end of a left femur. It is broken transversely across the upper shaft 9·7 cm from what remains of the head, or upper condyle. Much of the great trochanter (trochanter major) and the proximal portion of the head, are missing. De Vis considered " These have been lost by abrasion while projecting above the surface of the creek bed ". However, this bone has been removed much more recently than when the shaft was broken and has the appearance of having been cut by a sharp instrument, probably a ploughshare, which has exposed the cancellous tissue (which, incidentally, agrees perfectly with that exposed in other moa bones broken in similar places).

De Vis used *Dinornis* in the sense of Owen who placed all Moas in the one genus. De Vis wrote " this bone is in much the same peculiar state of mineralization as the great majority of the Darling Downs fossils ", a strange statement, as it is on this point that the bone differs very strongly from the Darling Downs bones whereas in this particular the holotype agrees strongly with many bones from Moa-hunter middens.

His excellent original description reads, in part: " The shaft at its place of fracture is rather more rounded than in D. crassus . . . Its section is a full, irregular oval, as in D. elephantopus, very dissimilar to the pure oval of Dromornis, but somewhat less unlike that of the emu's femur, in which the inner side is rather more convex than the outer. The base of the head presents a strong annular constriction . . . which, as in

Dinornis, renders the head quite distinct from the neck . . . and contrasts it with the subsessile heads of Dromaeus and Dromornis . . . In Dinornis crassus there is a subcentral pit nearer to the hinder part of the periphery of the head and excavated to a moderate depth. In the fossil . . . it is in a similar position, but deeply sunken, and its hinder edge is raised into a rough ridge. In neither D. crassus nor in the fossil is there a concave slope behind the ligament pit. The neck . . . of our subject is distinctly longer and narrower than in D. crassus, and consequently more divergent in both respects from that of Dromaeus. The neck at its junction with the epitrochanterian surface . . . is far more deeply hollowed than in the emu, and therefore conspicuously unlike that of Dromornis, in which the upper outline is nearly horizontal. The saddle so formed is in fact more deeply seated than in D. crassus. The outer surface of the trochanter . . . is nearly flat, devoid of the sub-marginal convexity shown in Dromaeus, and the muscular attachments . . . are in two shallow depressions raised above the level of the bone by two tubercular outgrowths, as in Dinornis, instead of into two excavations from the surface, separated by a bridge, as occurs in the emu. The mode of origin of the great trochanter of the fossil strongly resembles that of the moa—it rises abruptly from the shaft, and forms immediately a prominence, which curves over towards the inner aspect of the bone, and overlooks the markedly concave interior surface between it and the head".

Hutton (1893) disagreed strongly with De Vis' attribution of the bone to the Moa group, and published figures, outline drawings, viewed end on from the top of the holotype bone and "*Euryapteryx ponderosus*" (= *Pachyornis elephantopus*) to show the differences which he thought existed. *Pachyornis* is a genus which varies greatly in size and shape from one skeleton to another, and Hutton must have used an abnormally shaped femur for comparison, for, as I shall show later, the holotype bone agrees very well with *Pachyornis* and *Euryapteryx* in this particular, as Oliver also realised.

For comparison I have used four left femora of *Pachyornis elephantopus* and four of *Euryapteryx gravis* (the latter equating with "*Dinornis crassus*" in the sense in which De Vis used this name) all from more or less complete skeletons from Pyramid Valley swamp, North Canterbury, New Zealand, so that there can be no doubt as to their correct attribution to genera and species, as well as other femora from cave, swamp and midden deposits. As stated above *Pachyornis elephantopus* is a variable species and so is *Euryapteryx gravis*. Although the two genera are not closely related the leg bones, by convergent evolution, often resemble each other, and it requires careful study, when dealing with an odd bone or fragment thereof, to decide to which of the two genera it belongs. Oliver (1949) discussing the holotype states: "The depression on the head for the round ligament is deep and angular with several large perforations. In moas this depression is shallow on the surface level". While this statement is in general true, there are exceptions. In the femur of *Pachyornis elephantopus* AV8382 from Pyramid Valley, the depression is almost as deep as in "*Dinornis queenslandiae*" and is surrounded by a "lip" of bone outgrowth. This skeleton is of a very mature bird. A left femur, from Kapua Swamp, Waimate, AV9170, also of a very mature *Pachyornis*, again has this depression almost as deep as in the bone under consideration. It is probably a

sign of age. It certainly varies greatly in *Pachyornis* but much less so in *Euryapteryx*. The neck of the holotype is well defined below by an irregular transverse groove. This is characteristic of *Pachyornis*. In *Euryapteryx*, usually, this groove is broader and not quite so clearly defined. The rear portion of the trochanter of the holotype projects as in all the genera of Moa. Ironically, this is a feature which Hutton considered *distinguished* "queenslandiae" *from the Moa*. The trochanter is markedly produced forward. Although much of the cnemial crest thus produced is absent, being removed when the proximal portion of the trochanter was sheared off, sufficient—3·9 cm—remains to form an important diagnostic feature in distinguishing the bone as *Pachyornis* rather than *Euryapteryx*. It is one of the few features remaining on the bone which can be used for this purpose. In *Dromiceius* and *Casuarius* the cnemial crest, in profile, is a smooth curve. In all the genera of Moa it is irregular in outline and particularly so in *Pachyornis* and *Euryapteryx*. In both genera the crest begins as a "bulge" near the shaft, dips inward, then curves outward around the proximal end of the trochanter. It is the shape of the remaining lower portion of the crest which places the holotype definitely as *Pachyornis* rather than *Euryapteryx*, more clearly than any other feature remaining on the bone. There is always a little intra-specific variation, but this is not nearly as marked as the inter-specific differences in this particular. In *Euryapteryx* the cnemial crest begins with a much more gradual slope from the shaft to form the "bulge" than in *Pachyornis*, where the cnemial crest begins abruptly. In the holotype the "bulge" would originally have been even more pronounced than it is now as abrasion has slightly reduced the edge. This feature is shown well in Oliver's fig. 61C. Viewed from the front of the bone (the dorsal aspect) it begins slightly below the level of the roughened surface which forms the attachment for the iliacus internus muscle. (This muscular attachment, or scar, varies in position in both the genera under consideration. In some femora it is nearly level with, in others well above, the beginning of the cnemial crest and it also varies considerably in size, shape and position in relation to the neck; it cannot be used as a diagnostic feature.) The dorsal pretrochanteric surface is concave, agreeing well with both *Pachyornis* and *Euryapteryx*. A ridge running from close to the trochanter diagonally from right to left towards the shaft (cf. Oliver's fig. 61B) can be paralleled in some, but not all, *Pachyornis* femora. This again is a variable feature and along with the pronounced blood vessel markings and the roughened surface of the pretrochanteric region, fairly prominent in the holotype, is probably a sign of age. They occur in varying degress on some, but not all, of the femora used for comparison. (Blood vessel markings on tibio-tarsi, although varying a little intra-specifically, form consistently differing patterns between the genera and are a good diagnostic feature.) On the ventral and outer faces the muscle scars and other markings are variable in both shape and position in *Pachyornis* and *Euryapteryx*. Those on the holotype fit well into the *Pachyornis* pattern. Oliver considered the muscular impressions on the holotype bone more prominent than in *Pachyornis elephantopus* but they can be paralleled in very mature examples of the latter. Measured transversely across the pretrochanteric face, at the lowest point where it is possible to get a complete measurement, the shaft measures 5·75 cm and from front to back at the same relative position 4·5 cm. Measured in the same position, six *Pachyornis elephantopus* femora

were: 5·15/4·3 (=1·20); 5·3/5·0 (=1·06); 5·4/4·75 (=1·14); 5·55/4·8 (=1·16); 5·8/4·6 (=1·26); and 6·1/4·95 (=1·23) while five *Euryapteryx gravis* were: 4·9/4·1 (=1·20); 5·4/3·9 (=1·38); 5·5/4·3 (=1·28); 5·5/4·6 (=1·20); and 5·55/4·7 (=1·18) respectively.

It is obvious that the lower range of *Pachyornis* cannot be separated from *Euryapteryx* by measurement at this point. Most *Pachyornis* and *Euryapteryx* femora, where sectioned specimens are available for measurement, have densely solid, thick walls and the holotype is no exception. The lumen, or hollow centre, measures 1·1 x 0·9 cm, the walls varying from 1·3 to 2·2 cm. Very occasionally in both species one finds a large lumen and comparatively thin walls, e.g. a lumen of 2·1 x 1·6 cm, walls from 1·0 to 2·4 cm in *Euryapteryx*, but the holotype is in the usual range of thickness and density of bone for both genera. There is not one feature on it which cannot be paralleled in *Pachyornis elephantopus* when a sufficient range of the latter is examined and while it in general appearance also closely resembles *Euryapteryx gravis*, the differences in the groove defining the neck, and more particularly in the shape of the cnemial crest, separate it from that species. My conclusion, therefore, is that "*Dinornis queenslandiae*" is a New Zealand *Pachyornis elephantopus*.

There remains the question of its midden derivation. When I first saw the bone I was impressed by the shaft break as typical of that made by human agency when the bone was "green". I have handled thousands of moa bones from caves, swamps and sandhills, and have not found one instance where sub-fossil bone was broken in the same way that fresh, green bone breaks. The difference is not easy to convey in words. Figs. 61A, B, C and D in Oliver show the shaft break from four angles. Even though the surface of the break on the holotype is now partly obscured by traces of plaster left when casts were being made, it has all the appearance of a man-made break. Sub-fossil Moa limb bones when broken accidentally or purposely usually, although not always, fracture longitudinally. When they *do* break *across* the shaft the appearance differs considerably from "green" breaks. I have made many experiments breaking and cutting Moa bone from various sub-fossil sources and whether it is comparatively light bone from sandhills or "ivory" from swamps, the appearance is very different from "green" bone broken or cut. Mr. L. Lockerbie, of Otago Museum, independently made similar experiments, with the same results. In my opinion the shaft break on the holotype was made by man when the bone was green.

The reasons for concluding that the holotype came from the South Island and not the North Island of New Zealand are as follows: *Pachyornis elephantopus* is very rare in the North Island, where it is known from two localities only—Waipukurau (skeletons were found here buried with other genera under an ash-shower) and a cave in the Mahoenui area (a single tibio-tarsus was found in October 1967). In the North Island *P. elephantopus* has not so far been discovered in human association. It is not particularly common in the Moa-hunter middens in the South Island, being known from those at Papotowai, Pounawea, Hawkesburn, Tai Rua and Shag River (Southland and Otago sites) and Redcliffs, Sumner, a few miles from Christchurch, Canterbury. The *Pachyornis* found in North Island middens belong to the much smaller *P. mappini*

and *P. septentrionalis*. *Euryapteryx gravis*, very common in South Island middens, was a very rare bird in the North Island, being confined to the East Coast, and there is only one midden record, a single part femur from a midden in the Wellington area, where it could possibly have been taken across Cook Strait from the South Island.

It is improbable that we shall ever know from which South Island midden the holotype was derived. Very few were known when De Vis described it. As Miss Eleanor Crosby has suggested (pers. comm.), Shag River is a distinct possibility. It may have been ploughed up from an unrecorded site. This is all speculation, probably profitless. The most that can be said with certainty is that the bone was derived from a South Island Moa-hunter Maori midden.

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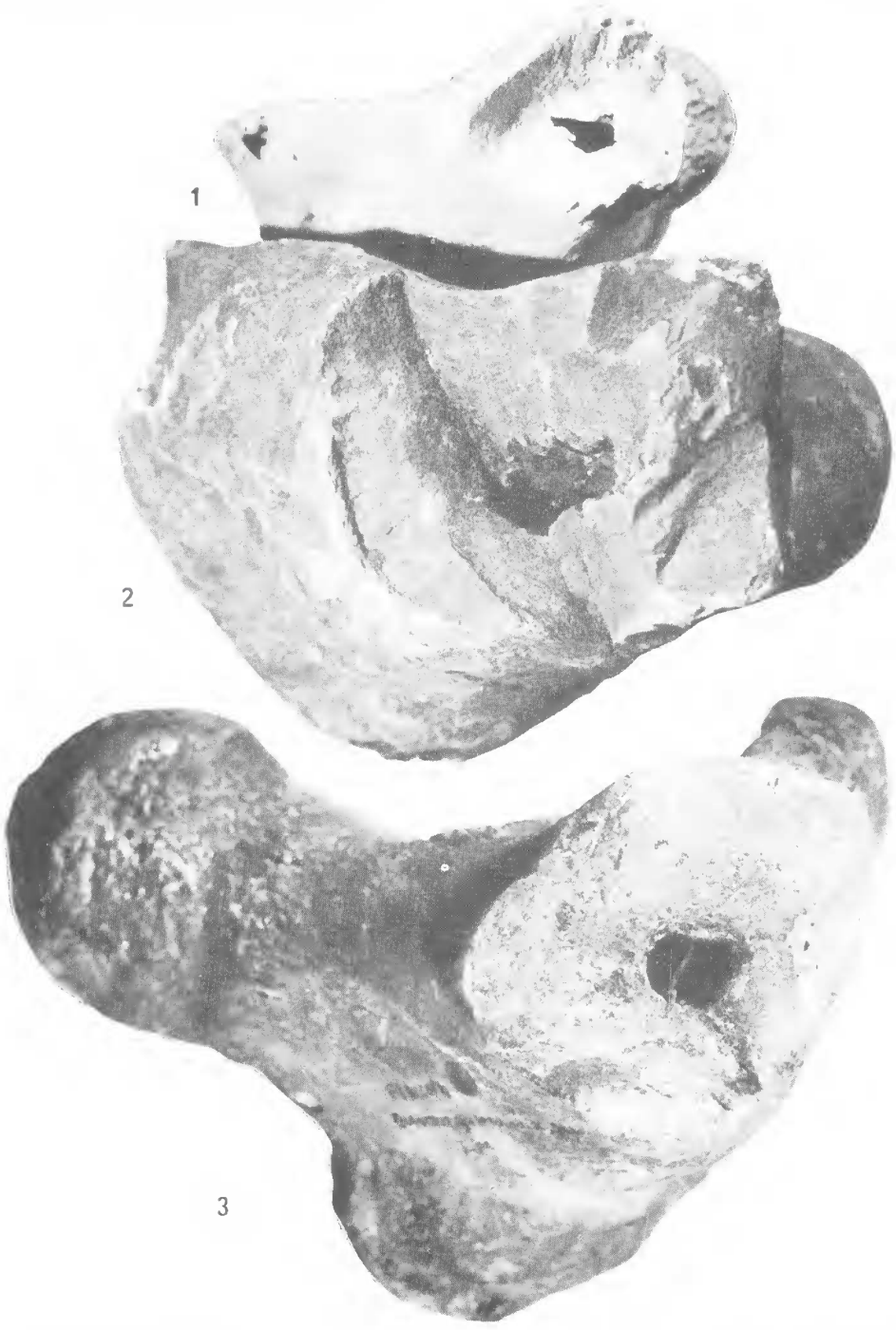

FIG. 1: Right femur of *Euryapteryx* sp., AV27579, Moa-hunter midden, Old Neck, Stewart I., N.Z.
FIG. 2: Right femur of *Euryapteryx gravis* (Owen), AV17651, Moa-hunter midden, Tairua, Otago, N.Z.
FIG. 3: Left femur of " *Dinornis queenslandiae* " De Vis, holotype, F1116.

Front face upwards in all cases.